

## Efficacy of Unilateral Greater Occipital Nerve Block in Migraine Management: A Focused Approach for Targeted Relief

### Migren Yönetiminde Unilateral Büyük Oksipital Sinir Blokajının Etkinliği: Hedefe Yönelik Yaklaşım

Ceyhun Sayman<sup>1</sup><sup>ID\*</sup>, Buse Rahime Bayır<sup>2</sup><sup>ID</sup>, Gizem Gürsoy<sup>3</sup><sup>ID</sup>, Kerim Şahin<sup>4</sup><sup>ID</sup>, Yılmaz Çetinkaya<sup>2</sup><sup>ID</sup>

1.Department of Neurology, Alanya Research and Education Hospital, Alaaddin Keykubat University, Antalya, Türkiye

2.Department of Neurology, Haydarpaşa Numune Research and Education Hospital, Health Science University, İstanbul, Türkiye

3.Department of Neurology, Umraniye Research and Education Hospital, Health Science University, İstanbul, Türkiye

4.Department of Anesthesiology, Alanya Research and Education Hospital, Alaaddin Keykubat University, Antalya, Türkiye

#### ABSTRACT

**Aim:** Migraine is one of the most common and disabling neurological disorders, causing a great deal of suffering both from an individual perspective and a public health point of view. Patients often suffer from either lack of efficacy or adverse reactions of oral treatments. The Greater occipital nerve (GON) block has recently come forward as a potentially useful choice for migraines. This study, therefore, assessed unilateral GON block to treat migraine.

**Methods:** A total of 35 patients with migraine were included in this prospective study. The frequency, duration, pain severity and analgesic consumption of headaches were evaluated at baseline and 1 week, 1 month and 3 months post-treatment in GON block. The primary outcome measures included changes in the number of migraine attacks, duration, and the severity of pain using a visual analogue scale (VAS).

**Results:** A substantial decrease was shown in the median number of migraine attacks, from 12 at baseline to 3 at month 3 ( $p=0.007$ ). The mean duration of migraine attacks reduced from 12 hours at baseline to 3 hours at month 3 ( $p < 0.0001$ ), and the mean VAS score was improved from 10 at baseline to 4 at month 3 ( $p < 0.0001$ ). There was also a significant reduction in analgesic use from 12 at baseline to 2 doses per month ( $p=0.005$ ).

**Conclusion:** Our results show that unilateral GON block is an efficient and well-tolerated intervention for migraine patients, significantly decreasing headache frequency, intensity and duration.

**Keywords:** Migraine, Greater occipital nerve block (GON), Visual analogue scale (VAS)

#### ÖZ

**Amaç:** Migren hem bireysel açıdan hem de halk sağlığı perspektifinden büyük acılara neden olan en yaygın ve engelleyici nörolojik bozukluklardan biridir. Hastalar, genellikle ağızdan alınan tedavilerin ya etkinlik eksikliği ya da yan etkileri nedeniyle sıkıntı yaşamaktadır. Son zamanlarda, Büyük oksipital sinir (greater occipital nerve-GON) blokajı migren tedavisinde potansiyel bir seçenek olarak öne çıkmıştır. Bu çalışma, bu nedenle, migren tedavisinde tek taraflı GON blokajını değerlendirmiştir.

**Yöntem:** Bu prospektif çalışmaya toplam 35 migren hastası dahil edilmiştir. Başlangıçta ve GON blokajı tedavisinden sonra 1 hafta, 1 ay ve 3 ayda baş ağrılarının sıklığı, süresi, ağrı şiddeti ve analjezik kullanımını değerlendirilmiştir. Birincil sonuç ölçütleri, migren ataklarının sayısındaki, süresindeki ve görsel analog skala (visual analogue scale- VAS) kullanılarak ölçülen ağrı şiddetindeki değişiklikleri içermektedir.

**Bulgular:** Migren ataklarının ortalama sayısının başlangıçta 12'den 3. aya kadar üçe düştüğü görülmüş ve anlamlı bir azalma gösterilmiştir ( $p=0.007$ ). Migren ataklarının başlangıçtaki ortalama süresi 12 saatten 3. ayda 3 saate düşmüştür ( $p < 0.0001$ ) ve başlangıçtaki ortalama VAS skoru 10'dan 3. ayda 4'e iyileşmiştir ( $p < 0.0001$ ). Ayrıca, alınan analjezik ilaç sayısı da başlangıçtaki 12 iken, 3. ayda 2'ye gerilemiştir ( $p=0.005$ ).

**Sonuç:** Sonuçlarımız, migren hastaları için tek taraflı GON blokajının, baş ağrısı sıklığını, şiddetini ve süresini önemli ölçüde azaltan etkili ve iyi tolere edilen bir müdahale olduğunu göstermektedir.

**Anahtar Kelimeler:** Migren, Büyük oksipital sinir blokajı (GON), Vizüel analog skala (VAS)

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\*Corresponding Author: Ceyhun Sayman, MD. Alanya Alaaddin Keykubat University, Alanya Research and Education Hospital, Department of Neurology, Antalya, Türkiye. Phone: +905556258929 / mail: ceysayman@yahoo.com.tr

ORCID: 0000-0003-2940-5186

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## Introduction

**M**igraine is a common neurological disorder characterized by recurrent attacks of headaches, nausea, vomiting, and photophobia [1]. Despite being less prevalent than chronic migraine, episodic migraine has a major impact on the quality of life and impairs productivity [2]. Migraine has traditionally been treated with medications such as triptans and prophylactic agents, as well as lifestyle changes and behavioral interventions [3]. However, with these choices, many patients continue to suffer from inadequate responses and side effects of medications, such as medication overuse, also known as rebound headache, which is a secondary headache disorder caused by the frequent or excessive use of acute headache medications. [4].

A potentially promising alternative in the treatment of migraine is the greater occipital nerve (GON) block, consisting of an anesthetic injection around a target area near the GON [5]. This helps to block the painful signals developed by the nerve, which further helps to treat migraine headaches [6]. However, most studies have reported bilateral GON blocks (i.e., both sides are treated). Although unilateral GON blockade directed at one side has been introduced and investigated in previous studies [7], its effectiveness has not been well established.

The purpose of this study was to determine the effectiveness of unilateral GON block in patients with episodic migraine. This approach may better delineate potential efficacy and adverse effects, offering important guidance to clinicians in the search for efficacious and patient-friendly migraine therapies. This study seeks to contribute to the growing body of evidence supporting GON block as a viable intervention for migraine management.

## Materials and Methods

The demographics of patients who were treated in the outpatient headache clinic of Haydarpaşa Educational and Research Hospital with a diagnosis of episodic migraine were reviewed prospectively after approval by the Ethics Committee (approval number: 2019/151) in accordance with the Declaration of Helsinki. The study period was October 2020 to October 2023.

Eligible patients comprised those over 18 and under 65 years diagnosed with migraine according to the International Classification of Headache Disorders, 3rd edition (ICHD-3) who had received unilateral GON block [8]. The exclusion criteria were prior allergic reactions, craniocervical surgery before or in this study, hemorrhagic diathesis (anticoagulant treatment), superficial infection of the area where GON blockade would be performed, not giving consent to the study, and incomplete medical records. Forty patients who met all inclusion criteria were included in the study. Patients who did not complete the 3-month follow-up period or those with missing medical data were excluded from the study. Eventually, the study included 35 patients. (Fig.1)

The study was followed by a patient-maintained headache diary, which noted the duration and days of occurrence (frequency rate) as well as severity on the visual analog scale (VAS) before and after treatment. The visual analog scale (VAS) assesses pain on a scale of 0 to 10, where 0 = no pain and 10 = the worst imaginable for both acute and chronic pain patients. Outcome measures were collected at three time points: baseline (pre-first GON block) and 1st and 3rd months post-treatment. The main outcomes were mean differences in headache frequency, duration, severity, and analgesic consumption. The outcomes were assessed at baselining and 1st month and 3rd month post-treatment, respectively.

The GON block protocol was used to mirror the process prior to each experimental session. The external occipital protuberance was palpated to identify the point of the injection. After disinfection of the antiseptic solution at the site of interest. Two milliliters of 2% lidocaine was injected suboccipitally to the area 2 cm lateral and inferior from the occipital protuberance (long-axis view) using a final common needle gauge for all patients along with a puncture point located at the occipital protuberance. Patients were monitored for 30 minutes after the procedure to record any immediate adverse effects. The GON block was repeated on a weekly basis for the first month and then once monthly for two additional months [9, 10].

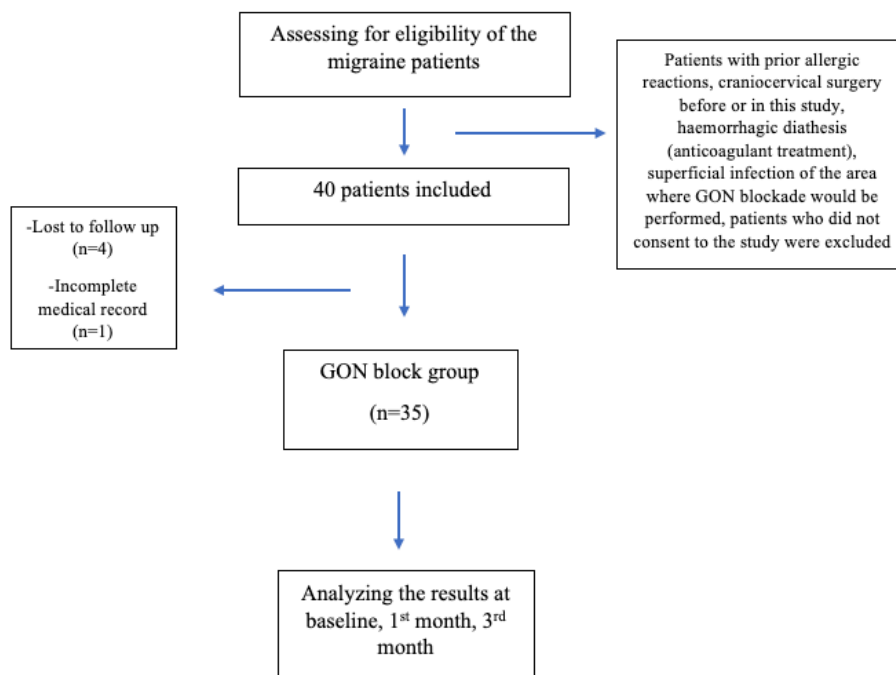


Figure 1. Flowchart of migraine patients

## Statistical Analysis

Quantitative data were analyzed using IBM SPSS Statistics version 21. All data were summarized using descriptive statistics, with categorical variables displayed as frequency (n and %) and continuous variables as mean (SD) and median (interquartile range [IQR]; 25th-75th percentiles). Data distribution normality was evaluated using the Kolmogorov-Smirnov and Shapiro-Wilk tests. As the data were not normally distributed, the Wilcoxon signed-rank test within-group comparisons were performed. Differences were considered statistically significant at a p-value of < 0.05.

## Results

A total of 35 patients were included in the study, with 32 (91.4%) females and 3 (8.6%) males in the unilateral GON blockade group. The prevalence of medication overuse was 45.7% (n=16). Prophylactic treatment was used by 51.4% (n=18) of patients in the unilateral group. Patient characteristics are detailed in Table 1.

The median number of migraine attacks also decreased significantly. At baseline, migraine attacks were 12 (6-15) per month, which decreased

to 1, 3, and 3 at weeks 1, 1, and 3, respectively. In contrast, the patients showed a significant reduction in the median number of analgesics. The mean analgesic use (12 at baseline) decreased to 1, 4, and 2 at weeks 1, 1, and 3, respectively.

Moreover, the duration of migraine attacks significantly decreased from a median of 12 (6-15) hours at baseline to 1 (1-3) hours at Week 1 ( $p < 0.0001$ ) to 3 (2-8) hours at Month 1 ( $p < 0.0001$ ) and to 3 (2-4) hours at Month 3 ( $p < 0.0001$ ). The median VAS scores in the patients decreased from 10 (8-10) at baseline to 6 (2-7) at weeks 1 to 5 (4-8) at months 1 and 4 (3-6) at month 3. The results are presented in Tables 2 and 3.

In comparison with baseline, at week 1, month 1, and month 3 of the monthly follow-up, unilateral GON blockade showed a statistically significant improvement in attack number, analgesic usage, and attack duration ( $p < 0.0001$  for all). No side effects were observed in any of the patients.

## Discussion

This study aimed to provide a comprehensive evaluation of unilateral GON block in the management of patients with episodic migraine. The results validate the supposition that one

Table 1. The patients demographic and clinical features: Gender, Mean of patients age, medication overuse, prophylactic treatment given.

	Unilateral GON Block n (%)
<b>Gender</b>	
Female	32 (91,4)
Male	3 (8,6)
<b>Medication overuse</b>	
Yes	16 (45,7)
No	19 (54,3)
<b>Prophylactic treatment</b>	
Yes	18 (51,4)
No	17 (48,6)
<b>Mean of patients age</b>	
Female	40,97
Male	34,25

Unilateral GON: Great Occipital Nerve Blok performed in one side

Table 2. Statistical evaluation of initial values and values at months 1, and 3 for VAS, attack duration, and monthly number of attacks and analgesics.

	Initial- Week 1 (p**)	Week 1- Month 1 (p**)	Month 1-Month 3 (p**)
Number of attacks	<0,001	<0,001	0,006
Number of analgesics	<0,001	<0,001	0,003
Attack duration	<0,001	<0,001	0,006
VAS	<0,001	0,29	0,006

VAS (Visual analogue scale)\*: Wilcoxon test

Table 3. Median values of initial, values at months 1, and month 3 for VAS, attack duration, and monthly number of attacks and analgesics.

	Initial Median Value (Median 25p-75p)	p*	Median Value Week 1 (Median 25p-75p)	p*	Median Value Month 1 (Median 25p-75p)	p*	Median Value Month 3 (Median 25p-75p)	p*
Number Of Attacks	12 (6-15)	0,45	1 (1-3)	0,25	3 (2-8)	0,27	3 (2-4)	0,007
Number Of Analgesics	12 (8-30)	0,91	0 (0-2)	0,18	4 (2-8)	0,21	2 (1-5)	0,005
Attack Duration	12 (6-15)	0,001	1 (1-3)	<0,001	3 (2-8)	<0,001	3 (2-4)	<0,001
VAS	10 (8-10)	0,33	6 (2-7)	0,45	5 (4-8)	0,72	4 (3-6)	0,04

VAS (Visual analogue scale) \* Mann Whitney-u Test

side of the GON block has the ability to improve headache as well as decrease its frequency of attack duration and intensity; therefore, it seems to be a beneficial treatment in patients with episodic migraine.

This reduction in headache frequency was consistent with prior work on bilateral GON blocks, which consistently demonstrated significant decreases in headache days per month following the treatment. Of note, our study extends these findings by showing that even a unilateral approach can produce equivalent improvements and may therefore offer a less invasive intervention for the management of migraines. An estimated 4 million patients with headache have chronic daily

headaches, the most disabling form of migraine [11].

An improvement in the number of headache days is important when considering overall patient health and well-being. Fewer days of headache not only diminishes the immediate load of pain but also reduces many comorbidities such as anxiety, depression, and medication overuse [12]. We observed a significant decrease in analgesic drug use in our patients.

The choice to use a unilateral model in this study was a decision that must be mindful of. Although widely practiced using the traditional method, bilateral GON blocks are associated with headache

or soreness on both sides as a common side effect. The rationale for utilizing a less invasive treatment approach, such as unilateral GON, included the expectation of at least equivalent effectiveness with respect to robust pain reduction and inconsequential rates of adverse events that are characteristic of bilateral interventions.

This was confirmed by our results in that the side effects were minimal and tolerable if GON blockade was performed unilaterally. It is in contrast to some literature on bilateral GON block that showed effectiveness; however, complications like bilateral soreness, discomfort, etc. can result in discomfort and less patient satisfaction [13, 14]. The lower risk profile associated with unilateral GON may render it a more appropriate choice for patients who are acutely sensitive to side effects or have contraindications to, and cannot tolerate, more aggressive treatments.

Whereas the bilateral GON block refers to bringing treatment to both sides, the unilateral GON block is situated only on one side. The approach was chosen because it would allow sufficient pain control with a low incidence of side effects [15]. Bilateral GON block may result in bilateral pain or collateral pain and discomfort (pain related to interscalene brachial plexus nerve block), which could be distressing for patients. The single GON block was found to be associated with no statistically significant adverse effects in our study, and we believe that this makes it a safer alternative for patients.

A major effect of our study was the decrease in analgesic intake after the unilateral GON block. This is an important consideration in the management of migraine, which is common and where medication overuse occurs. It occurs when a person uses acute or symptomatic medications too frequently, leading to worsening of symptoms rather than relief. Analgesic overutilization not only predisposes patients to medication-overuse headache, but also places a patient with serious medical difficulty with regard to overall headache management, usually associated with a vicious cycle of chronic pain and medication dependability [16].

Our data suggest that the GON block unilaterally is beneficial in reducing frequent requirements

of analgesics, which breaks this cycle and helps prevent the development of medication-overuse headaches. The decrease in the consumption of analgesics underlines the increase in patient comfort after treatment. We showed that mean analgesic use decreased from 12 at baseline to 1 at week 1, 4 at month 1, and 2 at month 3. This finding suggests that GON blockade is not only effective in pain control but may also form part of the effort toward reducing analgesic dependence. The decrease in analgesic requirement could be due to the longer duration of action of nerve block, which lowers the acute need for pain medication. These findings have important implications by demonstrating that in addition to the acute effect of reducing migraine pain, unilateral GON block could contribute to long-term treatment stability and lower healthcare utilization.

The noteworthy reduction in headache duration and intensity also confirms the effectiveness of unilateral GON block. This led to shorter and milder migraine attacks. One of the key determinants for increasing functionality and subsequently relieving not only daily functioning, but also decreasing the overall burden of migraine in patients. In our study, we showed that treatment likewise significantly shortened the duration of migraine attacks from a median of 12 hours (6-15) at baseline to 1 hour (1-3) at week 1, 3 hours (2-8) at month 1, and 3 hours (2-4) at month 3. Moreover, there was a marked improvement in the VAS scores, with median values decreasing from 10 (8-10) at baseline to 6 (2-7) at week 1, 5 (4-8) at month 1, and 4 (3-6) at month 3. These findings indicate a robust effect on the reduction in attack severity over time. The more disabled the patients, the greater their severity and duration. A unilateral GON block can reduce headache frequency and severity and could therefore be used as a more general treatment modality, especially if patients do not respond to or cannot tolerate pharmacological therapies [17, 18].

### Future Directions

Although this study provides new insights into the concept of unilateral GON block in patients with migraine, further studies are needed to explore its long-term benefits and modes of action. Although the exact physiological basis for symptomatic

relief following a GON block remains to be fully understood, speculations include effects on nociceptive pathways or central pain processing. It is also of interest to research the use of unilateral GON blocks in other headache disorders. Future research should also compare the effect of unilateral versus bilateral GON block in larger and more heterogeneous patient populations and guide practitioners toward more personalized treatments for patients with migraine.

## Conclusion

In conclusion, unilateral GON is an effective and well-tolerated treatment intervention for patients with migraine headache. This convincingly adds to the clinical trial evidence that it works and leads to a large drop in headache frequency, duration, and severity, as well as a reduced need for acute analgesics. The results highlight that unilateral GON block is a safe and effective therapeutic intervention that may serve as an alternative to other more invasive or systemic treatments owing to its favorable safety profile. Subsequent prospective studies on unilateral GON block might be directed towards investigating the long-term benefits, mechanisms of action, and its use in other types of headache disorders.

## Limitations

An episodic/chronic migraine subgroup analysis could not be performed because of the small sample size. The absence of a control group is a limitation of this study as it prevents direct comparisons and may affect the generalizability of the findings. The presence of auras was not mentioned because patients interpreted prodromes as auras, and the duration of the condition was not mentioned because the patients reported a wide window.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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**Ethics Committee Approval:** In this study, national and international ethical rules are observed. This study was approved by the Clinical Studies Ethics Committee of Haydarpaşa Numune Training and Research Hospital, (Decision number: 10-04 Dat: 19/10/2022)

**ORCID and Author contribution:** **C.S.(0000-0003-2940-5186):** Concept and Design, Manuscript Writing, **B.R.B.(0000-0001-5740-8822):** Data collection, Analysis and Interpretation, **G.G.(0000-0003-4448-5962):** Data collection, Analysis and Interpretation. **K.Ş.(0000-0003-3422-6756):** Literature search, Manuscript Writing, **Y.Ç. (0000-0001-7974-0260):** Critical Review

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